

Remarks

Reconsideration and reversal of the rejections expressed in the Office Action of January 6, 2006 are respectfully contended in view of the following remarks and the application as amended. The present invention relates to a Cu damascene structure, which is formed by treating the top surface of the surrounding low-k interlayer dielectric with a nitrogen or carbon containing medium, to form a silicon nitride or silicon carbide diffusion barrier, rather than capping the top surface of the Cu with a metal diffusion barrier, as is conventionally done.

Claims 1-6, 11-15 and 22-23 were rejected under 35 U.S.C. §102(a) as being anticipated by DeFelipe et al., U.S. Patent No. 6,541,374. The '374 patent relates to methods for forming diffusion barrier layers in the context of integrated circuit fabrication. Methods of the invention allow selective deposition of a metal-nitride barrier layer material on a partially fabricated integrated circuit having exposed conductor and dielectric regions, and conversion of the metal-nitride barrier material into an effective diffusion barrier layer having low via resistance. In a preferred method using TiN, differential morphology in a single barrier layer deposition is achieved by controlling CVD process conditions. Note that in order to enhance the prosecution of the present application, the claims have been further clarified as found above.

Claims 7-8 and 16-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over DeFelipe et al. in view of Sudijono et al., U.S. 2004/0092098. The Office Action states, inter alia, that it would be obvious to modify the DeFelipe step of forming a SiC layer by treating the surface of the low-k with plasma formed from carbon dioxide, as per Sudijono. The claims as clarified overcome this rejection.

Claims 9-10 and 18-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over DeFelipe et al. in view of Sudijono et al., and further in view of Lur et al., U.S. Patent No. 6,917,109. The Office Action states, inter alia, that it would have been obvious to modify De Felipe and Sudijono by the step of forming a copper barrier layer of SiC having a thickness of 50-500 angstroms as per Lur.

Sudijono et al. relates to an improved method of controlling a critical dimension during a photoresist patterning process which can be applied to forming vias and trenches in a dual damascene structure. The Examiner makes reference to paragraph [0024] of the reference; there it is noted that the barrier layer of silicon carbide (SiC) has a thickness of between about 200-1000 angstroms. In contrast, the present invention as disclosed and instantly claimed calls for a thickness of the SiC layer of preferably less than 50 angstroms. Such a low thickness is neither disclosed nor suggested by Sudijono et al.; indeed, by designating a thickness of SiC in the 200-1000 angstrom range, this reference teaches away from the lower value as presently claimed.

Lur et al. relates to an air gap structure and formation method for substantially reducing the undesired capacitance between adjacent interconnects, metal lines or other features in an integrated circuit device. At column 7, lines 53-55 of Lur et al., it is noted that a copper barrier layer such as SiC is deposited to a thickness of about 50-500 angstroms. As noted above relative to Sudijono et al., the claims as clarified by this Amendment and Response are neither taught nor suggested by Lur et al. as well, i.e., there is no teaching or suggestion in Lur et al. that a thickness of the SiC layer of less than 50 angstroms would be effective. Thus, this rejection is overcome.

Claims 20-21 and 24-27 were rejected under 35 U.S.C. §103(a) as being unpatentable over DeFelipe et al. in view of Okada et al., U.S. Patent No. 6,583,046; claims 28-30 were rejected under 35 U.S.C. §103(a) as being unpatentable over DeFelipe et al. in view of Okada et al. and further in view of Sudijono et al. The claims as clarified overcome these rejections as well.

For all of the above reasons, it is respectfully contended that the solicited claims define patentable subject matter. Reconsideration and reversal of the rejections expressed in the Office Action of January 6, 2006 are respectfully submitted. The Examiner is invited to call the undersigned if any questions arise during the course of reconsideration of this matter.

Respectfully submitted,

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